Planting Words and Ideas

SUMMARY
Students read Habitat Restoration and Diversity. Students become acquainted with the vocabulary of habitat restoration. Students generate questions that will help motivate their learning during the program.

TIME
1 hour

MATERIALS
- Computer with Internet access or copies of Glossary
- Habitat Restoration and Diversity
- Vocabulary Word Search

Lesson

Teacher explains to the class that the work they will perform at the native plant nursery is part of a habitat restoration project. Students will need to understand the vocabulary of habitat restoration so that they can fully understand the issues involved in the project.

Teacher distributes Habitat Restoration and Diversity. Students read the handout.

Teacher distributes the Vocabulary Word Search. Definitions to the hidden words are provided on the handout. To solve the puzzle, students must access the National Park Labs web site, go to the Glossary, and look for the words that match the definitions.

The class discusses and clarifies any definitions that they found difficult to understand.

As a group, the class brainstorms questions they have regarding habitat restoration or other aspects of *Here's the Dirt!* (the National Park Service, the history of the park, restoration projects, the student's role in the program, etc.).

Students choose the five most interesting questions from the brainstorming session.

They record these five questions in their notebooks. This is the first step in a questioning process that will continue throughout the program. The purpose of the questioning is not necessarily to find answers but rather to allow the questioning to evolve with deeper sophistication and understanding of the issues.

Extended Web Site Lesson

Students look at Inquiring Minds on the National Park Labs web site to find additional information about native plants and other issues related to habitat protection in Golden Gate National Recreation Area. They note the types of questions other students have asked. See www.nps.gov/goga/parklabs.

Habitat Restoration and Diversity

The San Francisco Bay Area used to be covered by sand dunes, creeks and coastal marshes. These natural areas provided habitats for many plant species and wildlife, including grizzly bears, gray whales, birds, and insects. Over the last two hundred years, urban development has disturbed these ecosystems and destroyed much of the animal and plant life. The small natural areas that remain are very fragile.

Golden Gate National Recreation Area is part of the National Park System, which is made up of nearly 400 areas covering more than 83 million acres. The National Park Service (National Park Service park rangers, scientists and other staff) works to protect and preserve the diversity of life in the public lands they manage. Restoration of indigenous habitat is one of the most important jobs done by National Park Service staff and community volunteers.

The goal of habitat restoration is to bring back the natural ecology of a site. How is this done?

- Make a step-by step plan of what actions to take.
- Remove invasive plants that disturb the natural balance of the site.
- Propagate plants that will be used to revegetate.
- Plant seedlings that have been raised in the nursery.
- Monitor and collect data to see what happens.

Whenever National Park Service staff work on habitat restoration, they try to maximize both species and genetic diversity. Diversity is critical because it increases an ecosystem's ability to thrive. For example, imagine that a pest invades a plant community. Could all the plants die? Yes, if all the plants have the same genetic makeup or are of the same species. But if there is genetic and species diversity, some of the plants are likely to survive.

Restauración del Hábitat y Diversidad

El Área de Restauración de la Bahía de San Francisco solía estar cubierto por dunas, riachuelos y ciénagas costaneras. Estas áreas naturales proveían hábitats para muchas especies de plantas y animales silvestres incluyendo osos pardos (grizzly), ballenas grises, pájaros e insectos. Durante los pasados doscientos años, el desarrollo urbano ha dislocado estos sistemas ecológicos y ha destruido gran parte de la vida animal y vegetal. Las pequeñas áreas naturales que quedan son muy frágiles.

El Área Nacional Recreativa Golden Gate es parte del Sistema Nacional de Parques, el cual se compone de 378 áreas que cubren más de 83 millones de acres. El Servicio Nacional de Parques (guardabosques, científicos y otro personal del SNP) trabaja para proteger y preservar la diversidad de formas vivientes en los terrenos públicos que manejan. La restauración de hábitats originales es uno de los trabajos más importantes realizados por el personal y la comunidad de voluntarios de SNP.

La meta de la restauración de hábitats es restablecer la ecología natural del lugar. ¿Cómo se logra esto?

- Crear un plan de las acciones que han de efectuarse, paso por paso.
- Remover plantas invasoras que perturban el balance ecológico.
- Propagar plantas que serán usadas para restablecer la vegetación.
- Sembrar plantas que han sido cultivadas en el vivero.
- Monitorear y recoger información para observar lo que ocurre.

Siempre que el personal del Servicio Nacional de Parques trabaja en la restauración de hábitats, trata de maximizar tanto las especies como la diversidad genética. La diversidad es importante porque mejora la habilidad de la planta para sobrevivir. Por ejemplo, imagínese que una plaga de insectos invade la comunidad de plantas. Si las plantas tienen las mismas características genéticas o son de la misma especie, pueden morir todas las plantas. Pero si hay diversidad genética y diferentes especies, algunas de las plantas pueden sobrevivir.

Planting Words

- Go to www.nps.gov/goga/parklabs.
- Locate the Glossary.
- Find the word that matches each definition on the next page.
- Locate the words in the puzzle below.

(If you don't have access to the Internet, use the Glossary provided by your teacher.)

N K P N P P S A N N U A L S P U P D
E T K A P A R F J D A A R X B S D U
P R N T K P R O V I S T T B B I K C
F F T U O F B T S H N F I S K A F K
O V V R P S L G Y T K F O Q M D F I
L A B A A U T E J F R S U V A H U N
E K E L L C N R Q K P A E S I V Y F
G V B I M C W M T A A P T A I P J L
U E P Z A E Y I E D P G J E Q O H O
M P U E T S M N V A P R D J U L N R
E D E D E S H A D M U E L C U L M E
P L T R L I F T G G S R J E O I P S
D O I S E O D E C I D U O U S N U C
P C O N A N E H R M I U L T R A S E
A D H J F H N S U C C U L E N T R N
W O O R Y R H I Z O M E N A M I Z C
R U S S E L L R A G F Z E K Y O K E
X O P P O S I T E L E A V E S N L E

_____: to sprout.

_____: when a plant has taken over the natural range of native plants and acts like it has always been a part of the original landscape.

_____: a liquid extract produced by steeping or soaking (like tea leaves, etc.) to extract flavors or other qualities.

_____: when the leaves are directly across from each other along the stem.

_____: completes its life cycle in one growing season and dies back each year; compare to perennial.

_____: a tuft of hair on the seed of a plant that helps to disperse the seed.

_____: when a plant loses its leaves in response to the cold season; opposite of evergreen.

_____: a plant that has thick, fleshy tissues that store water and help the plant resist drought conditions.

_____: the flowering part of a plant; almost always used when referring to a flower cluster.

_____: a leaf that is vaguely shaped like a hand, either because it is palmately lobed as in the case of a simple leaf or because, in a compound leaf, all leaflets radiate out from a central point.

_____: a plant whose life cycle lasts for several years; a plant that comes back year after year without having to be replanted each year.

_____: lying flat or trailing along the ground.

_____: a plant belonging to a large family of plants including peas, beans, clovers, etc.; the fruit is usually a pod; most have special nodules on their roots with nitrogen-fixing bacteria that can take nitrogen out of the air and "fix" it into the soil, thus increasing the richness of the soil for all plants.

_____: a thickened stem that looks like a root and grows horizontally along the ground just at or beneath the surface.

_____: when pollen is transferred to the stigma of flower's pistil leading to fertilization and seed production.

_____: the natural sequence of changes in a plant and animal community.

_____: germinar o brotar

_____: una planta que ha dominado el campo natural de una planta nativa y actúa como si siempre hubiera sido parte original del paisaje

_____: extracto de líquido producido mediante maceración o empapar (como el té, etc.) para extraer sabor u otras cualidades

_____: hojas compuestas que crecen en lados opuestos de un eje largo

_____: que completa su ciclo de vida en una temporada de crecimiento y muere cada año (compárese con perenne)

punta con pelos o filamentos que tienen las semillas de muchas plantas que les sirve para ser transportadas por el aire

_____: pierde sus hojas como consecuencia de las estaciones frías, en contraste a las siempre verdes

_____: una planta con tiene tejido carnoso y grueso que almacena agua y ayuda la planta a resistir condiciones de sequía

_____: la parte floreciente de una planta, casi siempre se refiere a ramos de flores

_____: hojas con forma parecida a una mano, bien sea una hoja simple con lóbulos ó una hoja compuestas donde las hojas irradian desde un punto central

_____: que crece continuamente; una planta cuyo ciclo de vida dura varios años; una planta que crece año tras año sin necesidad de ser re-sembrada cada año

_____: echada o rastrera, que crece tendida a lo largo del terreno

_____: una planta que pertenece a una gran familia de plantas que incluye el guisante, el fríjol, habas. El fruto es usualmente una vaina, la mayoría de las legumbres tienen nódulos especiales en sus raíces que contienen bacterias que pueden tomar nitrógeno del aire y "fijarlo" o depositarlo en el terreno, mejorando así la riqueza del terreno para todas las plantas

_____: Un tallo grueso que parece una raíz y crece echado a lo largo sobre o debajo del terreno

_____: cuando se transfiere el polen al estigma del pistilo de una flor causando fertilización y producción de semillas

_____: cambios progresivos en la vida vegetal o animal de un área

Return of the Wild!

SUMMARY
Return of the Wild! introduces students to the importance of maintaining biological diversity when propagating plants for habitat restoration projects. While playing Return of the Wild! students will discover that they score highest by collecting early-season, mid-season, and late-season germinators of a species. A post-game discussion helps students understand why this variation is essential. Return of the Wild! also familiarizes students with some of the more prominent species that grow in Golden Gate National Recreation Area. It presents some of the challenges that the National Park Service staff encounter in plant propagation, as well as some of the techniques they use to keep propagation success rates high. The game illustrates that it is impossible for people to entirely control the propagation process. Some cards in the compost pile describe things that can be controlled (how much water plants get, for example) but some describe things that cannot be controlled (a fox carcass rots and fertilizes a native plant community or a big storm wipes out the plants). Students find that the scores in Return of the Wild! fluctuate as these scenarios are encountered.

TIME
50 minutes

MATERIALS
- Return of the Wild! (7 sets provided by National Park Service)
- Score Sheet (Please find at end of *Classroom Preparation* section)
- List of plant communities
- Return of the Wild! Worksheet

Lesson

Teacher explains that students will play a board game to prepare for their visit to the native plant nursery. Teacher and students review plant communities.

Teacher divides the class into groups of 2 to 5 students and distributes the game boards and pieces. Teacher asks students to be certain to shuffle cards before beginning the game.

Students start by drawing ten cards each, moving along the board, and following the instructions on the cards they pick up along the way. If they begin with BONUS cards, they can draw the extra cards immediately.

Students play as much of the game as possible in ten minutes.

Teacher stops the game, passes out score sheets, and walks the students through the scoring procedure. Students tally their scores.

Once the scores are tallied, the teacher facilitates a group discussion:

Based on the scoring procedure, what is valued most in this game? Diversity. What types of diversity are valued? Diversity of species and genetic diversity within a species represented by early-season, mid-season, and late-season germinators. Why is it important to have early-season, mid-season, and late-season germinators within a species? So the species can better survive environmental disturbances. For example, early-spring germinators may not survive an early spring frost but mid-spring and late-spring germinators probably will.

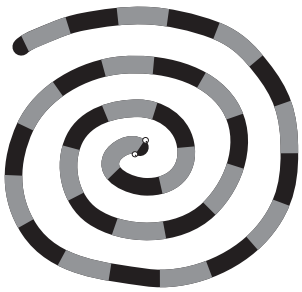
The key concept in successful ecological restoration with native plants is *natural selection, not cultural selection*. All aspects of the native plant nursery cycle emphasize the maintenance of genetic diversity; seeds are collected from many different plants, and both small (late-season germinators) and robust (early-season germinators) are transplanted.

After the discussion, the groups start a new game and try to beat their first scores. After ten minutes, students tally their round-two scores.

Students complete the Return of the Wild! Worksheet in class or as homework.

Students write one new question in their notebooks.

Return of the Wild! Worksheet



1. Describe three actions or events that increased your final number of indigenous plants.

_____

_____

_____

_____

2. Describe three actions or events that decreased your final number of indigenous plants.

_____

_____

_____

_____

3. Describe a strategy that would give you the highest score at the end of the game. How is your strategy related to the genetic diversity in a high-scoring hand?

_____

_____

_____

_____

_____

_____

4. Write your own two questions about native plants and nurseries.

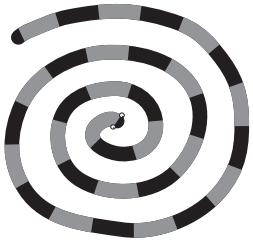
_____

_____

_____

_____

De Regreso a lo Nativo



Direcciones: Discute y contesta con tu grupo, las siguientes preguntas.

1. Describe tres acciones o eventos que aumentaron tu cantidad final de plantas nativas.

2. Describe tres acciones o eventos que disminuyeron tu cantidad final de plantas nativas.

3. Describe una estrategia que te dará la puntuación más alta al final del juego. ¿Cómo se relaciona tu estrategia con la diversidad genética para obtener una puntuación alta?

4. Escribe en tu cuaderno dos preguntas originales tuyas, sobre plantas nativas y el cuidado de plantas.

The Private Life of Plants

SUMMARY
Students watch the video, *The Private Life of Plants*, and complete a worksheet. The video explains how certain plants disperse their seeds with the assistance of biotic and abiotic components of the environment. By completing the worksheet, students begin to understand the ways in which plants depend on biotic and abiotic elements of their environment.

TIME
Two 50-minute class periods

MATERIALS
- TV/VCR
- *Private Life of Plants* video (provided by National Park Service)
- 8-9 objects to represent seeds (button, paperclip, marble, etc.)
- *Private Life of Plants* Worksheet

Lesson

Day 1
Teacher explains that students will view a video about plants. The video will address seed dispersal, interdependence between animals and plants, and the interactions between biotic and abiotic factors in plants' environments.

Students watch the 45-minute video.

Day 2
Students form small groups. Each group receives the *Private Life of Plants* Worksheet and an object that represents a type of seed. Students complete the worksheet together.

Each group presents to the class their "seed's" method of dispersal .

Students formulate two questions they have about interdependence based on the video and class discussion. They record them on the worksheet and in their notebooks.

Private Life of Plants Worksheet

Directions: Discuss and answer the following questions.

1. What are four different ways plants disperse their seeds?

a. _____ c. _____

b. _____ d. _____

2. Draw the host plant of your "seed."

3. Usually, we think of animals as dependent on plants. The video shows plants that depend on specific animals for the survival of the species. How does your host plant depend on animals?

_____

_____

_____

_____

4. Illustrate or describe how your "seed" is dispersed.

5. What are some abiotic and biotic factors in your host plant's environment?

ABIOTIC	BIOTIC

6. The video shows many complex interactions between abiotic and biotic components of the environment. What conditions would severely affect the interactions in the ecosystem of your host plant?

7. Write two questions you have about The Private Life of Plants.

Vida Privada de les Plantas

1. ¿Indica de qué cuatro maneras diferentes dispersan las plantas sus semillas?

a. _____ c. _____

b. _____ d. _____

2. Dibuja la planta huésped de tu "semilla" a continuación.

3. Usualmente, pensamos que los animales dependen de las plantas. La videocinta muestra que las plantas dependen de ciertos animales para la sobrevivencia de las especies. ¿Cómo depende tu planta huésped de los animales?

_____

_____

_____

5. Ilustra o describe como se dispersa tu "semilla."

3. ¿Cuáles son algunos factores abióticos y bióticos en el ambiente de tu planta huésped?

ABIÓTICO	BIÓTICO

6. La videocinta muestra muchas interacciones complejas entre los componentes abióticos y bióticos del ambiente. ¿Cómo afectará una sequía severa las interacciones en el ecosistema de la semilla de tu planta huésped?

7. Escriba dos preguntas que tenga sobre la videocinta.

Mystery Plants

SUMMARY
Students are introduced to the process of using a dichotomous key. They learn specific terms necessary to identify plants.

TIME
50 minutes

MATERIALS
- Computers with Internet access
- Mystery Plants Worksheet

Lesson

Teacher explains to the students that a dichotomous key is an important tool used by biologists to identify plants. The user of a dichotomous key must answer a series of questions about the plant he/she is trying to identify. Some of the questions are easy to answer but some take knowledge of plant biology or special vocabulary. Identifying the Mystery Plants will help students understand how to use a dichotomous key and learn some of the terms necessary to identify plants.

Teacher distributes worksheet. Students access the National Park Labs web site. Students complete the worksheet as they identify the Mystery Plants.

The class discusses the process of identifying plants. What kinds of things need to be observed in order to identify a plant? What new terms did students learn? Students will use their new observation skills and vocabulary when they work in the native plant nursery.

Students write a question about plant identification in their notebooks.

Extended Web Site Lesson
Students use the Glossary on the National Park Labs web site to reinforce plant identification skills. The Glossary includes definitions and drawings for different types of leaves.

Mystery Plants Worksheet

• Go to Golden Gate National Recreation Area's National Park Labs web site: www.nps.gov/goga/parklabs.

• Locate the section titled Can YOU Use a Dichotomous Plant Key?

At each step in a dichotomous key you are asked to choose between _____ for the plant you're trying to identify.

Mystery Plant #1

What is a simple leaf? _____

What is the common name for this plant? _____

Mystery Plant #2

What is an inflorescence? _____

What is the Latin name for this plant? _____

Mystery Plant #3

What are rhizomes? _____

Draw a picture of this plant on the back of this page.

Mystery Plant #4

What are dissected leaves? _____

This plant is a member of what family? _____

Mystery Plant #5

What are pedicels? _____

In what part of the world does this plant originate?

_____

Las Plantas Misteriosas

Llegue hasta la dirección electrónica del Laboratorio Nacional del Área Nacional Recreativa Golden Gate en la Internet: www.nps.gov/goga/parklabs. Localice la sección titulada ¿Puede USTED USAR una clave de plantas dicotómica?

A cada paso en una clave dicotómica se le pide que escoja entre _____ para la planta que usted está tratando de identificar.

Planta Misteriosa #1

¿Qué es una hoja simple? _____

¿Cuál es el nombre común de está planta? _____

Planta Misteriosa #2

¿Qué es una planta inflorescente? _____

¿Cuál es el nombre de esta planta en Latín? _____

Planta Misteriosa #3

¿Qué son rizomas? _____

Dibuje una ilustración de esta planta al dorso de esta página.

Planta Misteriosa #4

¿Qué son hojas disecadas o diseccionadas? _____

¿De qué familia es miembro esta planta? _____

Planta Misteriosa #5

¿Qué es un pedúnculo? _____

¿En qué parte del mundo se origina esta planta?

_____

Indigenous Landscape

SUMMARY
Students learn the habitats, characteristics and indigenous uses of plants grown in Golden Gate National Recreation Area nurseries. Students exchange information. They then generate questions for their notebooks.

TIME
40 minutes

MATERIALS
- Plant Identification cards (provided by National Park Service)

Lesson

Students form small groups. Each group reviews a Plant Identification card noting at least two interesting points of information. Groups share the information about their plants with the class.

Teacher facilitates discussion about indigenous plants based on information shared by students.

Students write in their notebooks at least one question they have about an indigenous plant.

Extended Web Site Lesson
The National Park Labs web site provides detailed information and color images of indigenous plants found within the boundaries of Golden Gate National Recreation Area. Students can access the web site and find the Plant Field Guide. Students can identify plants by their common names and scientific names. The guide also describes how and why certain exotic invasive plants threaten healthy ecosystems.

Common Grounds

SUMMARY
Students consider past and present land use. They compare and contrast values held by the indigenous people, Spanish and Mexican, United States military, and National Park Service. Students learn about these groups' interactions with and alterations of lands within Golden Gate National Recreation Area. Students use jigsaw method to exchange information. They then generate questions for their notebooks.

TIME
45 minutes

MATERIALS
- 2 sets of Land Use cards (provided by National Park Service)
- Land Use Worksheet

Lesson

Teacher explains that students will discuss how different people have used the land within Golden Gate National Recreation Area over time. Teacher divides students into eight groups. Each group receives one Land Use card and each student receives a worksheet to record her/his answers.

One student in each group reads the information on the card to the group. The group then discusses and answers the three questions on the back of the card. Students write their answers on the worksheet.

Students form new groups of four. Each new group has one student from each of the previous groups – indigenous people, Spanish and Mexican, United States Army, and National Park Service.

Students take turns sharing information from their first group discussion so that everyone understands the interactions and alterations on the landscape made during the four historic eras represented on the cards. Students record information about all the historic eras on the worksheet.

Teacher facilitates a class discussion about the influence of each historic group on the landscape, and the influence of the landscape on the group.

Students write two or more questions in their notebooks addressing the cultural values held by at least two of the groups.

Extended Web Site Lesson

Golden Gate National Recreation Area web site provides information about the park's history, people and habitats. The site includes color images of the most recent archaeological findings. Please see www.nps.gov/goga.

Land Use Worksheet

Directions: Answer the questions below while discussing the Land Use cards.

INDIGENOUS PEOPLE

1. What changes did this group make to the land?

2. What kind of impact did they have on the environment? Why?

3. What changes did this group make that might influence people living today?

SPANISH AND MEXICAN

1. What changes did this group make to the land?

2. What kind of impact did they have on the environment? Why?

3. What changes did this group make that might influence people living today?

U.S. MILITARY

1. What changes did this group make to the land?

_____

_____

_____

2. What kind of impact did they have on the environment? Why?

_____

_____

_____

3. What changes did this group make that might influence people living today?

_____

_____

_____

NATIONAL PARK SERVICE

1. What changes did this group make to the land?

_____

_____

_____

2. What kind of impact did they have on the environment? Why?

_____

_____

_____

3. What changes did this group make that might influence people living today?

_____

_____

_____

Hoja de Trabajo–Uso de la Tierra

Direcciones: Contesta las preguntas a continuación mientras discutes las Tarjetas de Uso de Tierras.

POBLACIÓN INDÍGENA

1. ¿Qué cambios le hizo este grupo a la tierra?

2. ¿Qué impacto tuvo esto sobre el ambiente ¿Por qué?

3. ¿Qué cambios hizo este grupo que puede influenciar a la gente que vive hoy día?

ESPAÑOLES Y MEXICANOS

1. ¿Qué cambios le hizo este grupo a la tierra?

2. ¿Qué impacto tuvo esto sobre el ambiente ¿Por qué?

3. ¿Qué cambios hizo este grupo que puede influenciar a la gente que vive hoy día?

EJÉRCITO DE LOS ESTADOS UNIDOS

1. ¿Qué cambios le hizo este grupo a la tierra?

_____

_____

_____

2. ¿Qué impacto tuvo esto sobre el ambiente ¿Por qué?

_____

_____

_____

3. ¿Qué cambios hizo este grupo que puede influenciar a la gente que vive hoy día?

_____

_____

_____

SERVICIO NACIONAL DE PARQUES

1. ¿Qué cambios le hizo este grupo a la tierra?

_____

_____

_____

2. ¿Qué impacto tuvo esto sobre el ambiente ¿Por qué?

_____

_____

_____

3. ¿Qué cambios hizo este grupo que puede influenciar a la gente que vive hoy día?

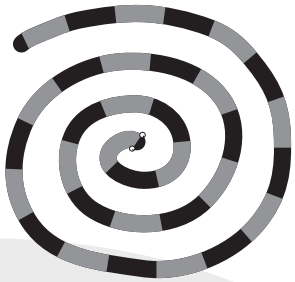
_____

_____

Return of the Wild! Score Sheet

INSTRUCTIONS:

- Check the boxes and circle the germination times that correspond to the plant cards in your hand. Give yourself one point for each plant you have checked.
- If you have all the plants in a community, check the community box. Give yourself one point for each community you have checked.
- If you have all three germination times for any plant, give yourself an additional 10 points for that plant. Total your points at bottom.



❑ FOREDUNE COMMUNITY

- ❑ Morning Glory early mid late
- ❑ Yellow Sand Verbena early mid late

❑ RIPARIAN COMMUNITY

- ❑ Bulrush early mid late

❑ DUNE SCRUB COMMUNITY

- ❑ Pearly Everlasting early mid late
- ❑ Coyote Brush early mid late
- ❑ Mock Heather early mid late
- ❑ Sticky Monkey Flower early mid late

❑ SERPENTINE BLUFF COMMUNITY

- ❑ San Francisco Wallflower early mid late
- ❑ Coast Buckwheat early mid late
- ❑ Yarrow early mid late

❑ SERPENTINE GRASSLAND COMMUNITY

- ❑ California Poppy early mid late
- ❑ Soap Plant early mid late

number of different plants _____

number of communities _____

number of diversity points _____

TOTAL POINTS _____